

C-130 IMPEX / INTEX-B Flight summary

date: 3 May 2006 (20060503)

flight number: 7

Take-off: 17:05:03 GMT

Landing: 01:35:10 GMT

Objectives:

- Canadian intercomparison with Cessna and ground site at Whistler Peak
- sample large-scale subsidence and entrainment over central California
- OMI validation spiral over Fresno followed by BL sampling south between Fresno and Bakersfield
- learn the models' predictive capabilities for Asian plumes

Instrument status:

SABL operated through the first half of the flight, and CO₂ measurements were not conducted on this flight. Otherwise, all instruments operated well.

Flight summary:

The C-130 flight was executed as planned. On initial ascent, a thin layer (~2000 ft) of enhanced scattering was observed at 15 kft containing elevated O₃ ~110 ppbv (versus ~75 below) and NO_y ~0.5 ppbv (versus 0.2 below). The spiral descent over Whistler Peak was conducted under clear skies and contact was established with the Canadian Cessna which conducted a profile over the site after our departure. On the descent over Whistler Peak, O₃ decreased from 100 to 55 ppbv, NO_y decreased from 0.5 to <0.1 ppbv, CO exhibited structure but only varied between 130-150 ppbv, and the nephelometer indicated enhanced scattering at 13 kft where PAN was also enhanced.

Heading to the south, no particular evidence of pollution was observed. Although dropped as an explicit flight objective, the C-130 pilots conducted an extremely close pass by the Mount Bachelor ground site (O₃ ~72, CO ~160, NO_y 0.4-0.5 ppbv). South of the Mount Bachelor site, very clean conditions (CO ~100, O₃ ~40, NO_y < 0.1 ppbv, very low scattering) were observed in the lower free troposphere (~9-16 kft). This clean layer was predicted by all of the models and persisted in observations over the entire southern portion of the flight. Air above this clean layer was more consistent with the higher-latitude background values observed on earlier flights (CO ~150, O₃ ~90, NO_y ~0.5 ppbv).

Upon reaching northern California, there was time to complete a boundary layer leg over the northern end of the central valley (ending at Sacramento) for contrast with the planned leg between Fresno and Bakersfield. Some cirrus was visible above the aircraft during this run. During the low altitude pass, conditions were extremely hazy with high scattering and ~10ug/m³ organic aerosol reported by the AMS. CO was ~185 (but varied up to 250), O₃ was ~60-65, and NO_y varied from 4-7 ppbv.

The OMI spiral was conducted just to the north of Fresno to avoid any interference with the local airport. Some high cloud was present during the spiral. This was followed by a boundary layer run from Fresno to Bakersfield where NO_y varied

from 2-5 ppbv which was less than the northern run, but O₃ was much higher (~80 ppbv). CO was ~180 ppbv, CH₂O ~1.5 ppbv, particle scattering was again high, and AMS reported aerosol masses of 1-3 ug/m³ organics, 1-3 ug/m³ sulfate, and ~1 ug/m³ nitrate. Returning north from Bakersfield, the aircraft climbed to 4500 ft where NO_y was still at 1.5 ppbv levels. The aircraft was nudged to 5500 ft (~1 ppbv NO_y), then to 6500 ft where NO_y dropped to 0.3 ppbv.

The extensive boundary layer sampling used considerable fuel and the aircraft profiled between 12-24 kft on the return north. During the return, what appeared to be aged Asian pollution was encountered at 20 kft (O₃ 100-110 ppbv, CO 150 ppbv, NO ~0.5 ppbv, PAN ~100 pptv, elevated SO₂ well correlated with HCN, large particles, sulfate exceeding 2 ug/m³). Moving out of this aged pollution was marked by reduction in O₃ from 100 to 75 ppbv, CO from 150's to 130's, NO_y was only half of the polluted value, and refractory aerosol component was reduced from 80% to 50%.

Overall summary. Flight objectives were mostly successful. The interaction with the Canadian research team and the pass by Mount Bachelor were well executed and will help facilitate analyses incorporating data from all of the platforms and ground sites. The OMI profile and boundary layer sampling over California's central valley will also provide an excellent validation opportunity. Evidence for subsidence and entrainment of Asian pollution is less likely to result from this flight. Model results updated on the morning of the flight showed a reduced chance of observing Asian pollution just above the BL, and in-flight observations gave no obvious sign of Asian pollution above the BL, although this can only be ruled out by a detailed examination of the flight data.